Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 72-75
Received: 13-07-2019
Accepted: 15-08-2019

Chetariya CP
Department of Genetics and Plant Breeding, J. A. U., Junagadh Gujarat, India

Pithia MS
Research Scientist (Chickpea), Pulses Research Station, J. A. U., Junagadh, Gujarat, India

Raval Lata J
Associate Professor, College of Agriculture, J. A. U., Junagadh Gujarat, India

Correspondence
Raval Lata J
Associate Professor, College of Agriculture, J. A. U., Junagadh Gujarat, India

Spectrum of genetic variation in *Desi* chickpea (*Cicer arietinum* L.) under normal and late sown condition

Chetariya CP, Pithia MS and Raval Lata J

Abstract
An experiment was conducted with a set of seventy-one genotypes of *Desi* chickpea to estimate genetic variability parameters in Randomized Block Design with three replications under normal (5th November) and late sown (3th December) conditions during *Rabi*-2016-17. The analysis of variance for both the sowing conditions revealed highly significant differences among the mean square due to genotypes for all the characters. The range of variation was comparatively wider in late sown condition than in normal sown conditions. In both the sowing conditions, wide range of variation was observed for seed yield per plant and 100-seed weight, number of pods per plant, number of primary branches per plant, plant height and reproductive phase duration. Development of short duration genotypes could be helpful in attaining higher seed yield in late sown condition before onset of end season temperature stress. The differences between phenotypic and genotypic coefficient of variation (PCV and GCV) were not substantial. In both conditions, the high to moderate values of GCV and PCV were observed for 100-seed weight followed by seed yield per plant numbers of pods per plant, numbers of primary branches per plant, plant height and reproductive phase duration. High heritability coupled with high/moderate genetic advance expressed as percentage of mean were exhibited by 100-seed weight, seed yield per plant, number of pods per plant, plant height, reproductive phase duration, number of primary branches per plant and days to 50 per cent flowering. So, these traits can be used as selection indices to improve seed yield in late sown condition as well as timely sown condition.

Keywords: Heritability, genetic advance, GCV, PCV, variability, chickpea

Introduction
Chickpea (*Cicer arietinum* L.) is the second most important food legume in the world. India is the largest producer of chickpea with annual production of 11.16 m tones from an area of 10.76 m ha with productivity of 1037 kg/ha during *Rabi*-2017-18 (Anon., 2018) [2]. Genetic variability for quantitative and qualitative characters of economic importance is a prerequisite for any crop improvement programme. Chickpea being a self-pollinated, lack of adequate variability and susceptibility of the present day cultivars to various abiotic and biotic stresses are the major bottlenecks in improving the productivity (Parameshwarappa *et al*., 2012 and Gaur *et al*., 2012) [13, 9, 10]. Seed yield of chickpea is a quantitative character which is affected by many genetic factors as well as environmental fluctuations. Therefore, variability studies under different environments provide useful information regarding pattern of changing variability under varied condition. Hence, present study was undertaken to assess variability for seed yield and related traits among the selected chickpea genotypes in two different dates of sowing normal and late (where temperature remained high during reproductive stages of crop).

Materials and Methods
Seventy one chickpea genotypes were evaluated in *Rabi*-2016-17 under two dates of sowing normal (5th November, 2016) and late (3th December, 2016) at Pulses Research Station, J. A. U., Junagadh, Gujarat in Randomized Block Design (RBD) with three replications. Each genotype was represented by single row of 4 m length each with spacing of 45 × 10 cm per replication. Five plants per replication and per genotype were randomly selected for recording the observations on reproductive phase duration, plant height (cm), number of primary branches per plant, number of pods per plant, 100-seed weight (g), seed yield per plant (g) and SPAD value (chlorophyll content index). Days to 50% flowering and days to maturity were recorded on plot basis. The analysis of variance for different characters was carried out by following Panse and Sukhatme (1985) [12]. Heritability in the broad sense was derived based on the formula given by Allard (1960) [1]. Genetic advance expressed as per cent of mean (GAM) was obtained by the formula prescribed by Johnson *et al*. (1955) [11].

The method adopted by Burton and De Vane (1953) [6] was used to calculate phenotypic (PCV) and genotypic coefficient of variation (GCV).

Results and Discussion

The analysis of variance revealed that mean squares due to seventy one genotypes of chickpea had highly significant differences for all the characters studied in both sowing conditions (Table 1) indicating presence of high genetic variability among the genetic material tested in the experiment suggesting ample scope of exploiting such variability through selection. These findings were supported by workers like Dehal *et al*. (2016) [7] and Barad *et al*. (2018) [5]. Most of the characters studied had exhibited wide range of variation under late sown conditions than normal sown conditions as evident from high coefficient of range. Wide range of variation was registered by 100-seed weight, seed yield per plant and number of pods per plant, while characters *viz*., reproductive phase duration, plant height and number of primary branches per plant also showed moderate phenotypic range under both the sowing conditions. Similar results were also reported by Babbar *et al*. (2015) [4] and Paul *et al*. (2018) [14]. Selection must be practiced on characters having wide range of variation under the respective sowing condition.

In general, none of the genotypes produced higher value of seed yield and its components in late sowing (Table 2 and 3). The number of days taken to complete reproductive phase duration was less in late sowing, when compared to normal sowing. This is reflected in mean values of the days to 50% flowering and days to maturity. These differences in the mean values of the reproductive characters may be attributed to late sowing that hastened reproductive period and day to maturity. Particularly legumes are highly sensitive to abiotic stresses during the reproductive phases like pod and seed set (Devasirvatham *et al*. 2012) [9]. Environmental factors such as temperature and water availability affect seed growth rate and final seed size in chickpea. This shows that these characters more sensitive to the environmental conditions. Similar conspicuous differences in the mean as an effect of environment were obtained by Parameshwarappa *et al*. (2012) [13]. Therefore, importance should be given to early maturing genotypes in late sown condition.

Due to influence of environment, the estimates of PCV were higher than that of GCV in both the sowing conditions (Table 2 and 3). In both the sowing conditions (normal and late), the high to moderate PCV was observed for 100-seed weight (24.49%, 25.82%) followed by seed yield per plant (17.40%, 29.15%) numbers of pods per plant (15.61%, 20.13%), numbers of primary branches per plant (13.09%, 17.39%), plant height (11.96%, 13.55%) and reproductive phase duration (10.66%, 11,23%). The GCV of all the characters said above were also found high to moderate except reproductive phase duration. The high values for these traits have also been reported by Desai *et al*. (2017) [8] and Barad *et al*. (2018) [5]. The presence of high amount of genetic variability in the evaluated germplasm for the major yield contributing characters along with seed yield indicating that further improvement of these traits is possible. These findings suggest that selection can be effective based on phenotypic along with equal probability of genotypic values. With the help of GCV alone, it is not possible to determine the extent of variation that is heritable. Hence, the knowledge of heritability helps the plant breeders in prediction. The genetic advance for quantitative characters aids in exercising necessary selection procedure. An estimate of heritable fraction of variability is of paramount importance in any crop improvement programme.

High estimates of heritability (> 60%) were observed for seed yield per plant and all the component characters studied under normal and late sown conditions. In both sowing conditions, moderate to high value of GAM were reported in 100-seed weight (49.53, 52.33), seed yield per plant (33.30, 57.77), number of pods per plant (30.50, 39.36), plant height (22.52, 26.16), number of primary branches per plant (20.03, 28.50), reproductive phase duration (19.00, 17.23) and days to 50 per cent flowering (16.57, 12.83). These results indicated that additive gene action controlling the expression of the traits and that phenotypic selection for improvement of these traits could be brought about as it has high heritability as well as GAM values. These results were in agreement with those of Parameshwarappa *et al*. (2012) [13], Desai *et al*. (2017) [8] and Babbar and Tiwari (2018) [3].

Thus, the present study suggests that selection for high seed yield should be based on 100-seed weight, numbers of primary branches per plant, plant height and number of pods per plant. Therefore, due emphasis may be given on these characters for selecting high yielding genotypes in chickpea.

Table 1: Analysis of variance showing mean squares for various characters in 71 genotypes of chickpea under normal and late sown conditions during *Rabi*-2016-17

		Mean squares								
Source	**d. f.**	**Days to 50 per cent flowering**	**Days to maturity**	**Reproductive phase duration**	**Plant Height (cm)**	**No. of primary branches per plant**	**No. of pods per plant**	**100-Seed weight (g)**	**Seed yield per plant (g)**	**SPAD value**
Normal sown										
Replications	2	26.2019	17.7605	12.0751	19.9207	0.0154	0.3640	0.7028	0.0051	6.7318
Genotypes	70	64.5121**	69.1388**	88.0272**	88.6913**	0.3273**	171.4931**	52.8848**	5.6979**	17.3926**
Error	140	5.3161	7.3605	11.8608	7.6093	0.0841	8.8812	0.9577	0.4023	3.8521
Late sown										
Replications	2	12.0610	1.1409	12.5681	124.0473**	0.6280**	2.9566	1.1453	0.1831	41.1237**
Genotypes	70	43.6238**	53.5139**	46.0684**	82.3876**	0.3821**	153.7469**	48.1852**	7.5573**	23.3359**
Error	140	6.0944	8.0980	11.7443	5.1491	0.0781	7.8121	0.7929	0.2872	6.1090

*,** Significant at 5% and 1% levels, respectively

Table 2: Range of variation, coefficient of range, mean and different genetic parameters for various characters in 71 genotypes of chickpea under normal sown condition during *Rabi*-2016-17

Character	Range	Coefficient Of range	Mean ± S.Em	Genotypic coefficient of variation (GCV) (%)	Phenotypic coefficient of variation (PCV) (%)	Heritability (Broad Sense) (%)	Genetic advance	Genetic advance expressed as percent of mean (GAM)
Days to 50 per cent flowering	43.67-63.00	18.12	52.89 ± 1.33	8.40	8.80	91.76	8.77	16.57
Days to maturity	94.67-115.00	9.70	103.72 ± 1.57	4.38	4.63	89.35	8.84	8.52
Reproductive phase duration	39.33-64.00	23.87	50.83 ± 1.99	9.91	10.66	86.53	9.66	19.00
Plant height (cm)	33.20-59.40	28.29	45.47 ± 1.59	11.43	11.96	91.42	10.24	22.52
No. of primary branches per plant	1.67-3.27	32.39	2.52 ± 0.17	11.28	13.09	74.31	0.51	20.03
No. of pods per plant	32.87-69.30	35.66	48.43 ± 1.72	15.20	15.61	94.82	14.77	30.50
100-seed weight (g)	11.39-35.37	51.28	17.15 ± 0.57	24.26	24.49	98.19	8.49	49.53
Seed yield per plant (g)	4.87-12.29	43.24	7.92 ± 0.37	16.77	17.40	92.94	2.64	33.30
SPAD value	55.83-68.17	9.95	63.38 ± 1.13	3.35	3.80	77.85	3.86	6.09

Note: GCV, PCV, GAM; 0-10 - Low; 10-20 - Medium; > 20 - High
h^2; 0-30 - Low; 30-60 - Medium; > 60 - High

Table 3: Range of variation, coefficient of range, mean and different genetic parameters for various characters in 71 genotypes of chickpea under late sown condition during *Rabi*-2016-17

Character	Range	Coefficient Of range	Mean ± S.Em	Genotypic coefficient of variation (GCV) (%)	Phenotypic coefficient of variation (PCV) (%)	Heritability (Broad Sense) (%)	Genetic advance	Genetic Advance expressed as percent of mean (GAM)
Days to 50 per cent flowering	42.33-61.00	18.07	52.67 ± 1.43	6.71	7.24	86.03	6.76	12.83
Days to maturity	77.00-95.00	10.47	87.58 ± 1.64	4.44	4.82	84.87	7.38	8.43
Reproductive phase duration	24.00-46.67	32.08	34.91 ± 1.98	9.69	11.23	74.51	6.01	17.23
Plant height (cm)	28.87-57.00	32.76	38.69 ± 1.31	13.12	13.55	93.75	10.12	26.16
No. of primary branches per plant	1.33-2.80	35.59	2.05 ± 0.16	15.51	17.39	79.57	0.58	28.50
No. of pods per plant	22.47-59.00	44.84	35.56 ± 1.61	19.61	20.13	94.92	14.00	39.36
100-seed weight (g)	10.07-32.83	53.05	15.52 ± 0.51	25.61	25.82	98.35	8.12	52.32
Seed yield per plant (g)	3.15-11.29	56.37	5.45 ± 0.31	28.59	29.15	96.20	3.15	57.77
SPAD value	52.10-69.10	14.03	61.28 ± 1.43	3.91	4.55	73.82	4.24	6.92

Note:- GCV, PCV, GAM ; 0-10 - Low; 10-20 - Medium; > 20 - High
h^2 ; 0-30 - Low; 30-60 - Medium; > 60 - High

References

1. Allard RW. Principles of Plant Breeding. John Willey and Sons, New York, 1960.
2. Anonymous. Project Coordinator's Report, All India Coordinated Research Project on chickpea. ICAR-Indian Institute of Pulses Research, Kanpur, 2018, 22-25.
3. Babbar A, Tiwari A. Assessment of genetic variability and yield stability in chickpea genotypes under diverse environments. Int. J Curr. Microbiol. App. Sci. 2018; 7(12):3544-3554.
4. Babbar A, Pandey S, Singh R. Genetic studies on chickpea genotypes grown in late sown under rice fallow conditions of Madhya Pradesh. Electron. J Plant Breed. 2015; 6(3):738-748.
5. Barad SH, Javia RM, Solanki HV, Panera A. Estimation of genetic variability for *Kabuli* chickpea (*Cicer arietinum* L.) under timely and late sowing condition. J Pharmacog. Phytochem. 2018; 7(4):421-423.
6. Burton GW, De Vane EH. Estimation of heritability in tall fescue from replicated clonal material. Agron. J. 1953; 45:478-481.
7. Dehal IB, Kalia R, Kumar B. Genetic estimates and path coefficient analysis in chickpea (*Cicer arietinum* L.) under normal and late sown environments. Legume Res. 2016; 39(4):510-516.
8. Desai PB, Patil BS, Vijayakumar AG, Basavarajappa MP. A comparative analysis of genetic variability and correlation in chickpea under normal and late sown conditions. Green Farming. 2017; 8(2):266-270.

9. Devasirvatham V, Gaur PM, Mallikarjuna N, Tokachichu RN, Trethowan RM, Tan DKY. Effect of high temperature on the reproductive development of chickpea genotypes under controlled environments. Funct. Plant Biol. 2012; 39:1009-1018.
10. Gaur PM, Jukanti AK, Varshney RK. Impact of genomic technologies on chickpea breeding strategies. Agron. J. 2012; 2:199-221.
11. Johnson HW, Robinson HF, Comstock RE. Genotypic correlation in soybean and their implication in selection. Agron. J. 1955; 47:477-483.
12. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. (3rd Revised Ed.) ICAR, New Delhi, 1985.
13. Parameshwarappa SG, Salimath PM, Upadhyaya HD, Patil SS, Kajjidoni ST. Genetic variability studies in mini-core collection of chickpea (*Cicer arietinum* L.) under different environments. Karnataka J Agri. Sci. 2012; 25:305-308.
14. Paul PJ, Samineni S, Thudi M, Sajja SB, Rathore A, Das RR *et al*. Molecular mapping of QTLs for heat tolerance in chickpea. Int. J Mol. Sci. 2018; 19:1-20.